Applicants appreciate the Examiner's indication that dependent claims 7, 18 and 29 include allowable subject matter. Applicants also appreciate the Examiner's withdrawal of the objections and rejections set forth in the previous Office Action.

In the present Office Action, claims 1-6, 11-17, 22-28 and 33-51 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,987,011 to Toh in view of U.S. Patent No. 5,491,837 to Haartsen. Furthermore, claims 8-10, 19-21 and 30-32 are rejected under 35 U.S.C. § 103(a) as being unpatentable the Toh and Haartsen patents in view of U.S. Patent No. 6,307,843 to Okanoue. These rejections are respectfully traversed.

As discussed in detail below, Applicants respectfully submit that neither the Toh, Haartsen nor Okanoue patent teaches or suggests a system, method or computer readable medium of instructions that assigns a *link quality value* to a communication link between transmitting and receiving nodes based on the specific criteria recited in independent claims 1, 12 and 23. Namely, neither patent teach or suggests assigning a link quality value based on a transmit power level value *at which the data packet was transmitted by the transmitting node*, as well as a received sensitivity value of the receiving node that receives the data packet, and a received signal strength indication value provided by the network. Rather, the Toh patent discloses the counting of respective identifier beacons (ticks) associated with respective links to determine the stability or longevity of each of the links. The Haartsen patent, on the other hand, discloses techniques for determining transmit power for signals transmitted between a base station and mobile stations in a conventional

mobile cellular system using frequency division multiple access (FDMA), time division multiple access (TDMA) or code division multiple access (CDMA) transmitting schemes. The Okanoue patent discloses the use of a link table to identify wireless links between mobile hosts in an ad-hoc network.

The claimed embodiments of the present invention will now be discussed with regard to the cited references.

As discussed in the Remarks of the Amendment filed in response to the previous Office Action, the present invention provides a system, method and computer readable medium of instructions for evaluating at least one communication link between nodes in a communication network. In particular, these nodes are fixed or mobile wireless nodes operating in an-hoc communications network. As described beginning, for example, at paragraph 0023 on page 6 of the present application, each node in the network periodically broadcasts routing advertisements to other nodes within its broadcast range. A broadcast routing advertisement includes information in its header pertaining to the transmit power level (TPL) at which the routing advertisement was transmitted. Furthermore, a receiving node can obtain the per-packet receive signal strength indication (RSSI) from the 802.11 physical layer implementation of the network. Also, each node is aware of its receive sensitivity (RS) value which, as described in paragraph 0023, is the "lowest level signal strength at which a received signal containing a data packet can be received in order for the node to be able to successfully recover data from the received data

packet." That is, when a node receives a data packet having a received signal value less than the threshold RS value, that node will treat the received signal as noise.

A link quality ratio (LQR) of the link between nodes can thus be determined based on an equation as set forth in paragraph 0023, which takes into account the transmit power level (TPL), receive signal strength indication (RSSI), *and* the receive sensitivity (RS) of the receiving node. Accordingly, as described in paragraph 0029, an assessment of the LQR from available links is done with the delivery of each packet. Therefore, when nodes are being used as intermediate nodes through which packets are routed from a source node to a destination node, the nodes whose links have the best LQR can be chosen as the preferred nodes through which to route the data packets.

As discussed above, independent claim 1 defines a system for evaluating at least one communication link between transmitting and receiving nodes in a communication network. The claimed system comprises a processor that is adapted to assign a link quality value to the communication link based on the TPL value at which the data packet was transmitted by the transmitting node, an RS value of the receiving node, and an RSSI value provided by the network. Independent claim 12 defines a method for assigning a link quality value based on these criteria, and independent claim 23 defines a computer readable medium of instructions for determining the link quality value based on these criteria. The dependent claims define further details of the system, method and computer readable medium of instructions as discussed below.

As stated in the Office Action, the Examiner contends that the Toh patent teaches a system and method for measuring the stability of communication links between neighboring mobile hosts in a communication network. However, the Examiner admits that the Toh patent fails to disclose the use of RSSI and RS values to measure the stability of the links. Nevertheless, for these features, the Examiner relies on the teachings of the Haartsen patent, in particular, Figures 5 and 6 which describe the use of RSSI of traffic channels, and contends that one skilled in the art would have found it obvious to modify the Toh system in accordance with these teachings to achieve the present invention as defined in the claims. Applicants respectfully disagree.

Specifically, as discussed above, the Toh patent describes a counting mechanism for counting respective identifier beacons (ticks) associated with respective links to determine the stability or longevity of each of the links. On the contrary, the embodiments of the present invention described in the present application use a combination of direct measurement of the packet at packet capture time (RSSI) and *a priori* knowledge of the capabilities and limitations (RS) of the receiver node for a given transmitted waveform at a given power level (TPL). Direct measurement using the packet analyzer is critical to fast mobile routing performance. That is, this type of direct measurement of link quality (LQ) has the benefit of instantaneous determination of the LQ between transmitter and receiver node, while the counting method used in Toh system takes much longer to determine an indirect measure of the quality of a link.

Hence, for mobile nodes, the protracted time it takes to make the LQ determination according to the method described in the Toh patent will directly impact the routing decision time.

Applicants note that each of independent claims 1, 12 and 23 explicitly recite the use of RSSI, RS and TPL to determine a link quality value.

The Haartsen patent, on the other hand, describes a *cellular voice system*, and not an ad-hoc network or, in particular, an 802.11 type local area data packet delivery network. In the Haartsen system, measurements are made at the mobile station (e.g., mobile station 370 or 380) in response to a request by a base station (e.g., base station 340, 350 or 360). The measurements are then sent to the base stations where computations are mode and a transmit power level (TPL) is determined by the base station for the mobile station. This TPL is sent to the mobile station which adjusts its transmit power level accordingly. Measurements are made so the power level can be reduced and not so that the per-packet measurement of LQ can be used to make routing decisions. Haartsen discusses maintaining an acceptable carrier to interference ratio while minimizing the transmit power level for the purpose of reducing. This is not the goal of the system in our patent application. This system measures LQ to determine the most suitable communication link to be used by an ad-hoc routing mechanism.

Furthermore, the Haartsen system measures specialized *pilot signals* instead of making LQ determinations in real-time on each data frame as in the embodiments of the present invention. That is, the Haartsen system is a client-server centralized cellular system where

mobile stations measure the RSSI of the pilot signals generated by the base stations and transmit the measurements to the base station. Path loss and transmit power level calculations are made at the cellular base station and served to the mobile stations where the power level is adjusted. This technique therefore requires many over the air frame exchanges to determine the transmit power level of the mobile station. On the contrary, the embodiments of the present invention do not provide a system that determines the transmit power level of a mobile station. Rather, the embodiments of the present invention measure the quality of a link for the purpose of choosing routes for data frames for a *given* transmitted power level. Furthermore, as can be appreciated by one skilled in the art, the communication system employing the embodiments of the present invention can be a completely distributed system that only requires one frame to be exchanged between transmitter and receiver in order to determine the LQ value for a particular communications link. Hence, there is no client-server relationship in the embodiments of the present invention.

For all these reasons, Applicants respectfully submit that one skilled in the art would not have been motivated, and thus, would not have found it obvious to modify the Toh system to include Haartsen's *cellular* channel allocation scheme to improve link quality determination in the Toh system. Again, the Haartsen system uses specialized pilot signals in pre-determined control channels in licensed frequency bands to make assumptions about the link quality in uplink and downlink channels. On the contrary, as can be appreciated by one skilled in the art,

802.11 wireless LAN radios communicate in *unlicensed* spectrum and thus, the same assumptions cannot be made as in a cellular network as taught by Haartsen. Rather, the LQ is determined in an unlicensed channel by directly measuring it on every data frame. The bursty nature of 802.11 data traffic in unlicensed channels makes per-packet measurement essential, and infrequent measurements yield incoherent LQ determinations in the noisy 802.11 channels.

As discussed above, each of independent claims 1, 12 and 23 explicitly recited that the RSSI, RS and TPL criteria are taken into account when assigning a link quality value. Hence, independent claims 1, 12 and 23, and their dependent claims, should be allowable over the Toh and Haartsen patents. Applicants further note that these patents fail to teach or suggest features in the dependent claims.

For example, dependent claim 2 defines the system as comprising a packet analyzer that examines a content of the data packet sent between the two nodes to determine the transmit power level. Dependent claims 13 and 24 define a method step and set of instructions, respectively, for performing this operation. Nowhere does the Toh patent or the Haartsen patent teach or suggest that the signals are transmitted in data packet format, and certainly these patents do not teach or suggest that the content of any such data packet is examined to determine the transmit power level. Dependent claims 3, 14 and 25 specifically recite that the RSSI value is determined from a physical layer of the communications network, which is also not taught or suggested by the Toh and Haartsen patents. In addition, since the Toh and Haartsen patents do

not teach or suggest the link quality value for the reasons discussed above, these patents cannot teach, suggest or render obvious the use of this link quality value to determine whether additional data packets should be sent on a particular communication link as recited in dependent claims 4, 15 and 26.

As discussed briefly above, nowhere does the Toh patent or Haartsen patent teach or suggest that the network include an ad-hoc wireless communications network, and that the nodes are wireless nodes in the ad-hoc wireless communications network, as is recited dependent claims 5, 16 and 27. The Toh and Haartsen patents also fail to teach, suggest or render obvious the specific employment of an 802.11-type network as recited in claims 6, 17 and 28, and certainly do not teach, suggest or render obvious the specific equation for calculating the link quality ratio as expressly recited in claims 7, 18 and 29, which are allowable as indicated by the Examiner.

Furthermore, because the Toh and Haartsen patents fail to teach or suggest the transmission of a signal in data packet format, these patents therefore must fail to teach, suggest or render obvious the technique of assigning a link quality value on a per packet basis as expressly recited in claims 11, 22 and 33. In addition, these patents fail to teach or suggest that a receiving node performs the operation for assigning the link quality value to the link between itself and the transmitting node as recited in dependent claims 34-51 that were added by the Amendment filed in response to the previous Office Action.

Concerning the rejection of dependent claims 8-10, 19-21 and 30-32 based on the Toh, Haartsen and Okanoue patents, Applicant respectfully submits that because the Toh and Haartsen patents do not teach or suggest the determination of a link quality value for the reasons discussed above, these patents also do not and can not teach, suggest or render obvious the assignation of a respective link quality value to each of the communication links between transmitting and receiving nodes as recited in claims 8, 19 and 30, as well as the route selection based on the link quality value recited in claims 9, 20 and 31. The Toh and Haartsen patents certainly do not teach or suggest that the route selection is based on the highest link quality value as is recited in claims 10, 21 and 32, because they do not even teach or suggest the calculation of any link quality value in the manner recited in the independent claims of the present application.

As discussed above, the Okanoue patent teaches the use of link table to identify wireless links between mobile hosts in an ad-hoc network. However, like the Toh and Haartsen patents, this patent fails to teach or suggest the use of RSSI, RS and TPL criteria to assign a link quality value to a link as recited in independent claims 1, 12 and 23. Accordingly, because the Okanoue patent fails to make up for the deficiencies in the teachings of the Toh and Haartsen patents as discussed above, Applicants submit that one skilled in the art would not have found it obvious or possible to modify the Toh system in accordance with the teachings of the Haartsen and Okanoue patents to achieve the embodiments of the present invention even as recited in independent claims 1, 12 and 23. Hence, all claims should be allowable.

In view of the above, it is believed that the subject application is in condition for allowance, and notice to that effect is respectfully requested. However, should the Examiner have any questions, the Examiner is invited to contact the undersigned at the number indicated below.

Respectfully submitted,

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